Research Note 84-73

(2)

INTEGRATING MPT INTO THE SYSTEM ACQUISITION PROCESS --IMPLEMENTATION OF THE DEPUY-BONDER APPROACH--

Seth Bonder, W. Peter Cherry, George J. Miller, and Stanley L. Spaulding

Vector Research, Inc.

Dorothy L. Finley, Contracting Officer's Representative

Submitted by
Franklin L. Moses, Chief
BATTLEFIELD INFORMATION SYSTEMS TECHNICAL AREA

and

Jerrold M. Levine, Director
SYSTEMS RESEARCH LABORATORY

U. S. Army

Research Institute for the Behavioral and Social Sciences

May 1984

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Research Note 84-73	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Integrating MPT Into the System Acquisition Process -- Implementation of the DePuy-Bonder Approach --		5. TYPE OF REPORT & PERIOD COVERED 11 Sept 1981 - 18 April 1984 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Seth Bonder, W. Peter Cherry, George J. Miller, and Stanley L. Spaulding		8. CONTRACT OR GRANT NUMBER(s) MDA903-81-C-0579
9. PERFORMING ORGANIZATION NAME AND ADDRESS Vector Research, Incorporated P.O. Box 1506 Ann Arbor, Michigan 48106		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62717A, 2Q162717A790 2228,01
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Research Institute for the Behavioral and Social Sciences 5001 Eisenhower Avenue, Alexandria, VA 22333		12. REPORT DATE May 1984 13. NUMBER OF PAGES 104
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Contracting officer's representative was Dorothy L. Finley.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

manpower, personnel, and training; Army materiel acquisition process

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A previous research effort resulted in a conceptual framework for integrating manpower, personnel, and training (MPT) considerations into the Army's system acquisition process. This report describes the results of follow-on research to develop specific methods and means for implementing this conceptual approach. The approach involves two principal types of analysis: system specific man/machine analysis (which focuses on a specific system in the early stages of the acquisition process) and total force MPT analysis (which considers the impact

FORM

UNCLASSIFIED

of the new system on the MPT needs and capabilities of the entire force). The report describes the need for such analysis, outlines the conceptual approach, recommends specific tools and data for use in the analysis, describes the incorporation of the analysis into the current system acquisition process, recommends organizational changes within the Army to facilitate implementation of the approach, and outlines a proposed project to demonstrate the approach in the context of an actual system which is in the early stages of the acquisition process.

INTEGRATING MPT INTO THE SYSTEM ACQUISITION PROCESS

-- IMPLEMENTATION OF THE DEPUY-BONDER APPROACH --

Seth Bonder

W. Peter Cherry

George J. Miller

Stanley L. Spaulding

VECTOR RESEARCH, INCORPORATED

18 APRIL 1984

ACKNOWLEDGEMENT

This report describes work performed by Vector Research, Incorporated, (VRI) for the US Army Research Institute for the Behavioral and Social Sciences (ARI). The work was performed under contract number MDA903-81-C-1579. Dr. Frank Moses of ARI served as the Contracting Officer's Technical Representative.

We would like to acknowledge the contribution of Colonel Frank Bettinger and his staff at the US Army Soldier Support Center (National Capital Region) who provided valuable inputs throughout this project. Dr. Edgar Johnson and his staff at ARI also made useful suggestions. General William DePuy (US Army, Retired) helped structure the research and reviewed its results.

DePuy and Bonder [1982] have developed a conceptual framework for integrating manpower, personnel, and training (MPT) considerations into the Army's system acquisition process. This report describes the results of a study to develop specific methods and means for implementing the DePuy-Bonder conceptual approach.

The report begins with background information concerning the need for improved integration of MPT into the system acquisition process and the nature of the DePuy-Bonder concept. This is followed by discussions of the two principal types of analysis inherent in the concept: system specific man/machine analysis and total force MPT analysis. Organizational considerations in implementation of the concept are discussed next. This is followed by a description of a proposed project to demonstrate the implementation structure in the context of an actual system which is in the early stages of the acquisition process. The report concludes with a summary and brief statement of recommendations.

OUTLINE

- BACKGROUND
- SYSTEM SPECIFIC MAN/MACHINE ANALYSIS
- TOTAL FORCE MPT ANALYSIS
- ORGANIZATION AND RESPONSIBILITY
- DEMONSTRATION PROJECT
- SUMMARY AND RECOMMENDATIONS

The need for improved treatment of MPT in the system acquisition process is indicated by these two quotations of DePuy and Bonder [1982] and Kerwin and Blanchard [1990].

BACKGROUND

-- THE PROBLEM --

DEPUY AND BONDER:

"THE UNDISCIPLINED FRONT END OF THE PROCESS (DESIGN WITHOUT PERSONNEL CONSTRAINTS) APPLIED TO SYSTEM AFTER SYSTEM CREATES A RAPIDLY CUMULATING DEMAND FOR ADDITIONAL MANPOWER AND SKILLED PERSONNEL -- A DEMAND BEYOND THE CUMULATIVE CAPABILITY OF THE ARMY TO SATISFY."

KERWIN AND BLANCHARD:

"INCREASING WEAPON COMPLEXITY, THE LARGE NUMBER OF NEW SYSTEMS BEING DEVELOPED, INSUFFICIENT FORMAL SCHOOL TRAINING, A DECLINING MANPOWER POOL, DISPROPORTIONATE NUMBERS OF CAT IIIB AND CAT IV PERSONNEL, RECRUITING AND RETENTION PROBLEMS, AND UNIT TURBULENCE -- ALL WILL CONTINUE TO STRAIN THE OVERBURDENED PERSONNEL, TRAINING AND DEVELOPMENT COMMUNITIES."

The impact of insufficient integration of MPT into the acquisition process is that materiel systems which emerge from the process do less than is needed and/or cost more than is justified. Some examples are given here; sources for the examples are indicated in parentheses.

BACKGROUND

-- IMPACT --

RESULTING MATERIEL SYSTEM DOES LESS THAN NEEDED AND/OR COSTS MORE THAN JUSTIFIED

- STINGER SYSTEM RELIABILITY (PROBABILITY OF SUCCESSFUL PERFORMANCE OF CRITICAL ENGAGEMENT TASKS) WAS DESIGNED AT .64; BECAUSE OF HUMAN PERFORMANCE LIMITATIONS ACTUAL SYSTEM RELIABILITY IS ESTIMATED TO BE .44, A 30 PERCENT REDUCTION (ARI/TRASANA)

- ARMY DRAGON GUNNERS' RESPONSE TIMES (OT RESULTS: 3-FOLD INCREASE OVER QMR-SPECIFIED TIME TO FIRE SUBSEQUENT ROUNDS) AND TRACKING ERRORS (OT RESULTS: 27 PERCENT REDUCTION IN MOVING TARGET HIT PROBABILITIES, COMPARED WITH CONTRACTOR'S EXPERT GUNNERS) RESULT IN A DECREASE IN EXPECTED NUMBER OF ARMOR KILLS (ASAP/HEL/ARI)

- 11 MOS WITH INCREASED MANNING REQUIREMENTS DUE TO FORCE MODERNIZATION HAVE COURSE ATTRITION RATES IN EXCESS OF 40 PERCENT (SSC), E.G.:
  - MOS 45G, FIRE CONTROL SYSTEM REPAIRER -- 42 PERCENT
  - MOS 34Y, FIELD ARTILLERY COMPUTER REPAIRER -- 48 PERCENT

- 30 MOS (34 PERCENT OF THOSE WITH INCREASED MANNING OBJECTIVES DUE TO FORCE MODERNIZATION) ARE POTENTIALLY NOT SUPPORTABLE (SSC)

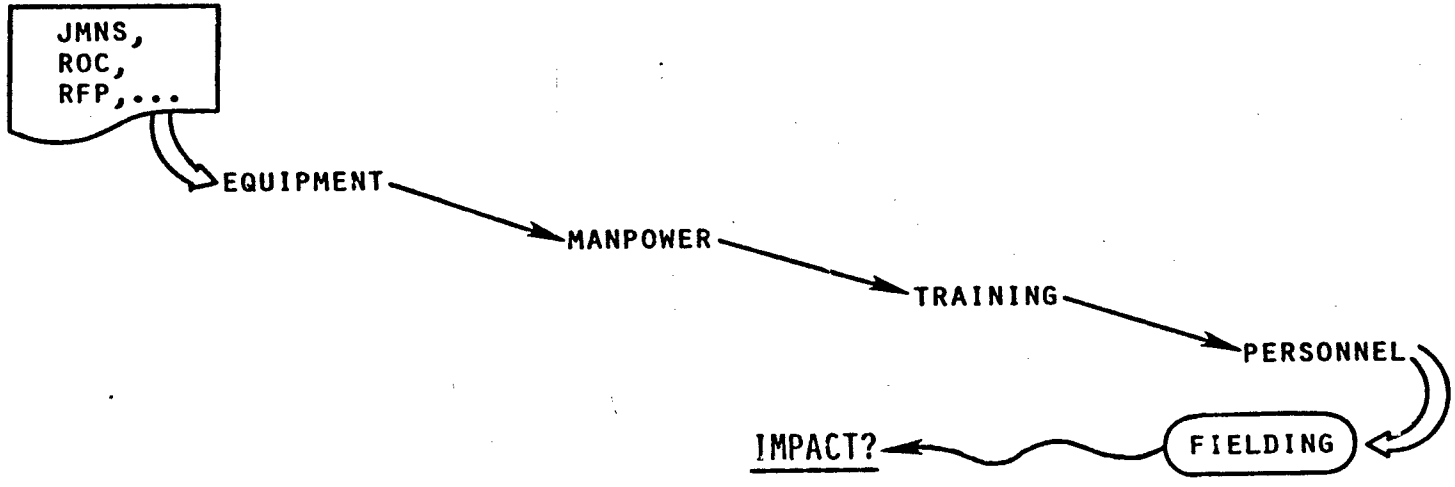
There are two major shortcomings of the acquisition process as currently conducted which lead to MPT-related problems in system performance and/or cost. First, the response of the acquisition process to a requirement tends to be sequential in nature. Equipment is designed first, followed by specification of manpower requirements, followed by specification of training requirements, followed finally by consideration of personnel. This sequential nature of the process means that equipment design cannot be modified to minimize the impact of MPT limitations on ultimate system performance.

The second shortcoming is that systems in the acquisition process are considered in isolation. Thus there is no capability to assess the impact of MPT demands of a single emerging system on the capability to supply appropriate personnel and training to the force as a whole. While an adequate quantity and quality of personnel and training can be found to support any single system, it may be impossible to support simultaneously the needs of all systems in the force modernization. The acquisition process does not now provide for consideration of this total force impact.

BACKGROUND

-- HOW DOES THIS PROBLEM GET STARTED? --

ACQUISITION PROCESS RESPONSE TO A USER REQUIREMENT IS SEQUENTIAL



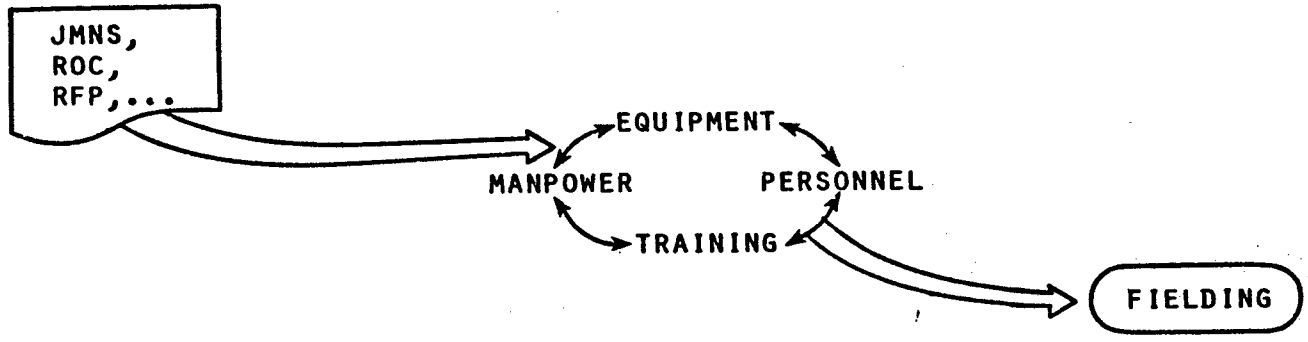
INDIVIDUAL SYSTEMS ARE CONSIDERED IN ISOLATION

It follows that consideration of equipment, manpower, training, and personnel within the acquisition process must be integrated. Furthermore, the capability must be developed to assess the supportability of the MPT requirements of an emerging system in the context of the possibly conflicting demands of the force as a whole. That is, the acquisition process must involve both a system focus and a total force perspective. The DePuy-Bonder concept addresses these needs.

BACKGROUND

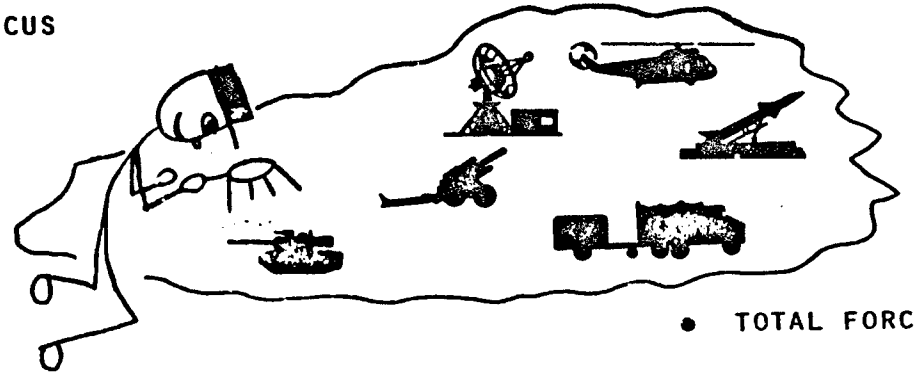
-- WHAT IS NEEDED? --

ELEMENTS OF THE ACQUISITION PROCESS MUST BE INTEGRATED



THE DCSPER MUST HAVE INFORMATION TO ASSESS SUPPORTABILITY OF MPT REQUIREMENTS DEVELOPED DURING THE ACQUISITION PROCESS

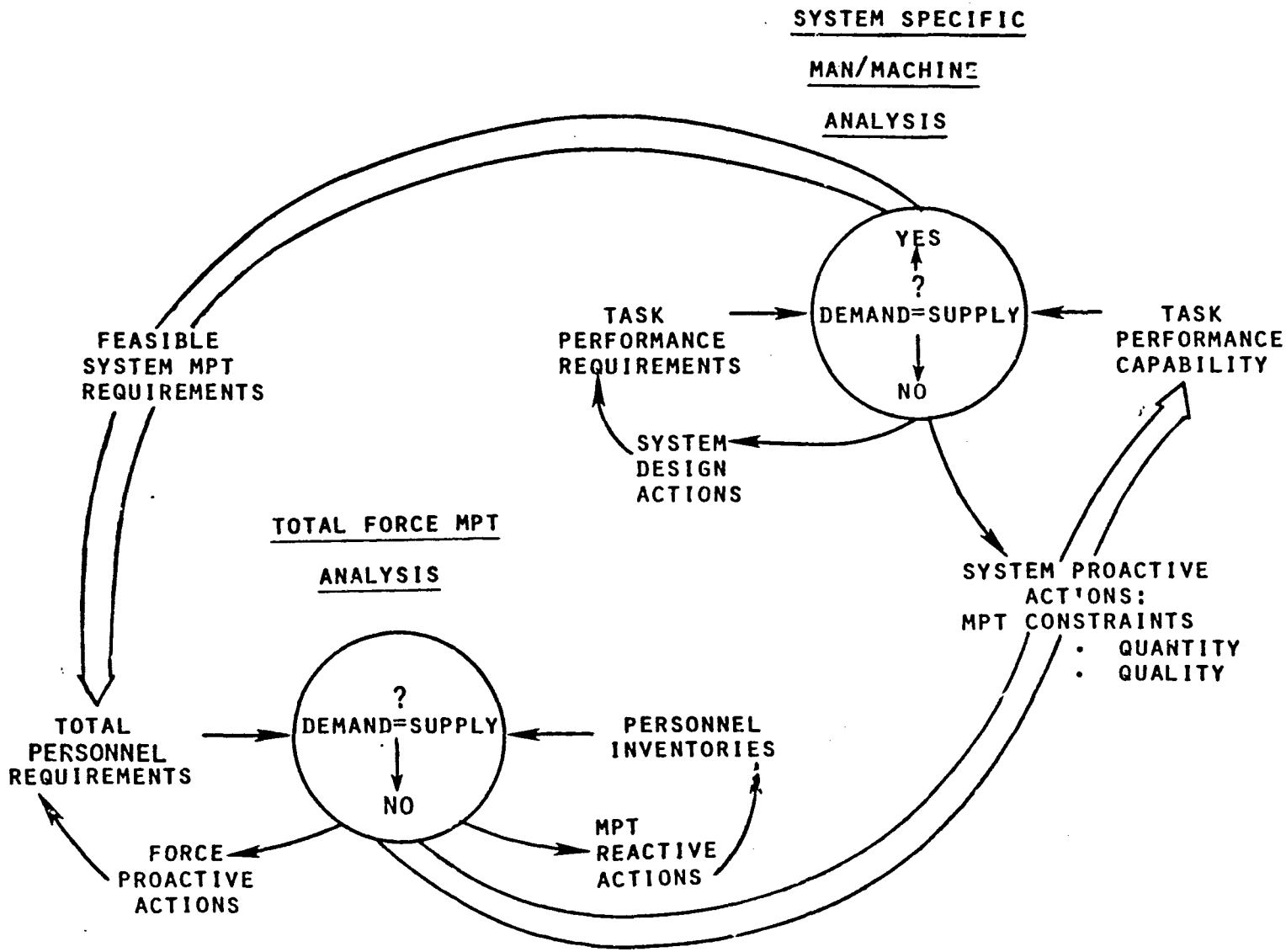
- SYSTEM FOCUS



- TOTAL FORCE PERSPECTIVE

BACKGROUND

-- THE DEPUY-BONDER CONCEPT --



The DePuy-Bonder concept involves conducting two types of interrelated analyses within the system acquisition process. This slide summarizes the nature of these two types of analysis and the interactions between them.[1] The upper right portion of the slide represents the system specific man/machine analysis. Central to this analysis is a comparison between the task performance requirements of an emerging system and the task performance capabilities of the trained personnel who can be made available to operate and maintain the system. If requirements exceed capabilities, two types of actions can occur. System design actions involve modifying the design so as to reduce the human task performance requirements of the system. (As an example from an earlier slide, if the inability of DRAGON gunners to track moving targets had been identified earlier in the process of designing the system, the tracking task might have been shifted from the gunner to the system, possibly by introducing a terminally guided weapon into the DRAGON design.) As an alternative to system design actions, the MPT constraints which led to the limited task performance capabilities can be relaxed by providing either higher quality personnel or additional training. (Some actions of this type have total force implications which are discussed below.)

When MPT demand and supply are equal for the system, the result is a feasible set of MPT requirements associated with that system. These contribute to the total personnel requirements for the force as a whole, which serve as input to the second type of analysis: total force MPT analysis. This

-- Continued --

[1] A more detailed depiction of the concept can be found in [DePuy and Bonder, 1982].

analysis also involves a demand/supply comparison, in this case between total future personnel requirements and projected future personnel inventories, i.e., a comparison between the kinds of people needed to fill the positions and the kinds of people projected to be available to fill them. If requirements exceed projected inventories, several types of actions can occur. MPT reactive actions involve changes to the manning system designed to provide the needed personnel inventories. Possible actions might include increases to recruiting advertising budgets, shifts in reenlistment bonuses, etc. Force proactive actions involve changes to the force modernization schedule to smooth out personnel requirements. Of greatest relevance to the system acquisition process are system proactive actions. These involve placing MPT constraints on new systems to assure that these systems can be manned appropriately when they are introduced into the force.

THIS PAGE INTENTIONALLY LEFT BLANK

The purpose of the current effort was to add operational details to the DePuy-Bonder concept. In particular, the research had three major objectives:

(1) to delineate an implementation structure for the concept, including specification of what activities must be conducted, when in the system acquisition process they must be conducted, and who should conduct them;

(2) to identify methods and data needed for use with the implementation structure both in the near term and longer range; and

(3) to design an analysis which demonstrates the implementation structure.

While methods and data needed for the implementation structure are far from complete today, this research is based on a belief that the DePuy-Bonder concept should be implemented immediately. Development of methodological details of the concept is an iterative process in which early experience in using the concept provides feedback concerning the need for additional data and improved methods. Development of a comprehensive methodology in isolation from such experience is less likely to produce a useful product. At the same time, immediate implementation of available methods and data provides some near-term opportunity for the Army to address its pressing need for improving the consideration of MPT in the system acquisition process. The remainder of this report describes the research results.

BACKGROUND

-- RESEARCH OBJECTIVES --

DELINEATE STRUCTURE FOR IMPLEMENTING THE DEPUY-BONDER CONCEPTUAL APPROACH IN THE ACQUISITION PROCESS

- WHAT?
  - WHEN?
    - WHO?

IDENTIFY METHODS, DATA BASES, ETC., FOR USE WITH THE IMPLEMENTATION STRUCTURE

- NOW
  - DOWNSTREAM

DESIGN A DEMONSTRATION ANALYSIS

The discussion of results begins with a description of the implementation structure for the system specific man/machine analysis.

OUTLINE

- BACKGROUND
- SYSTEM SPECIFIC MAN/MACHINE ANALYSIS
- TOTAL FORCE MPT ANALYSIS
- ORGANIZATION AND RESPONSIBILITY
- DEMONSTRATION PROJECT
- SUMMARY AND RECOMMENDATIONS

System specific man/machine analysis provides the system focus within the integration of MPT into the acquisition process. The nature of the system focus is outlined here.

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- THE SYSTEM FOCUS --

- ESTABLISH THE MANPOWER REQUIREMENTS TO ACCOMPLISH THE FUNCTIONS AND TASKS ALLOCATED TO THE HUMAN IN A NEW SYSTEM CONCEPT

- COMPARE THESE REQUIREMENTS WITH THE LEVEL OF PERSONNEL CAPABILITY THAT CAN BE MADE AVAILABLE TO THE SYSTEM

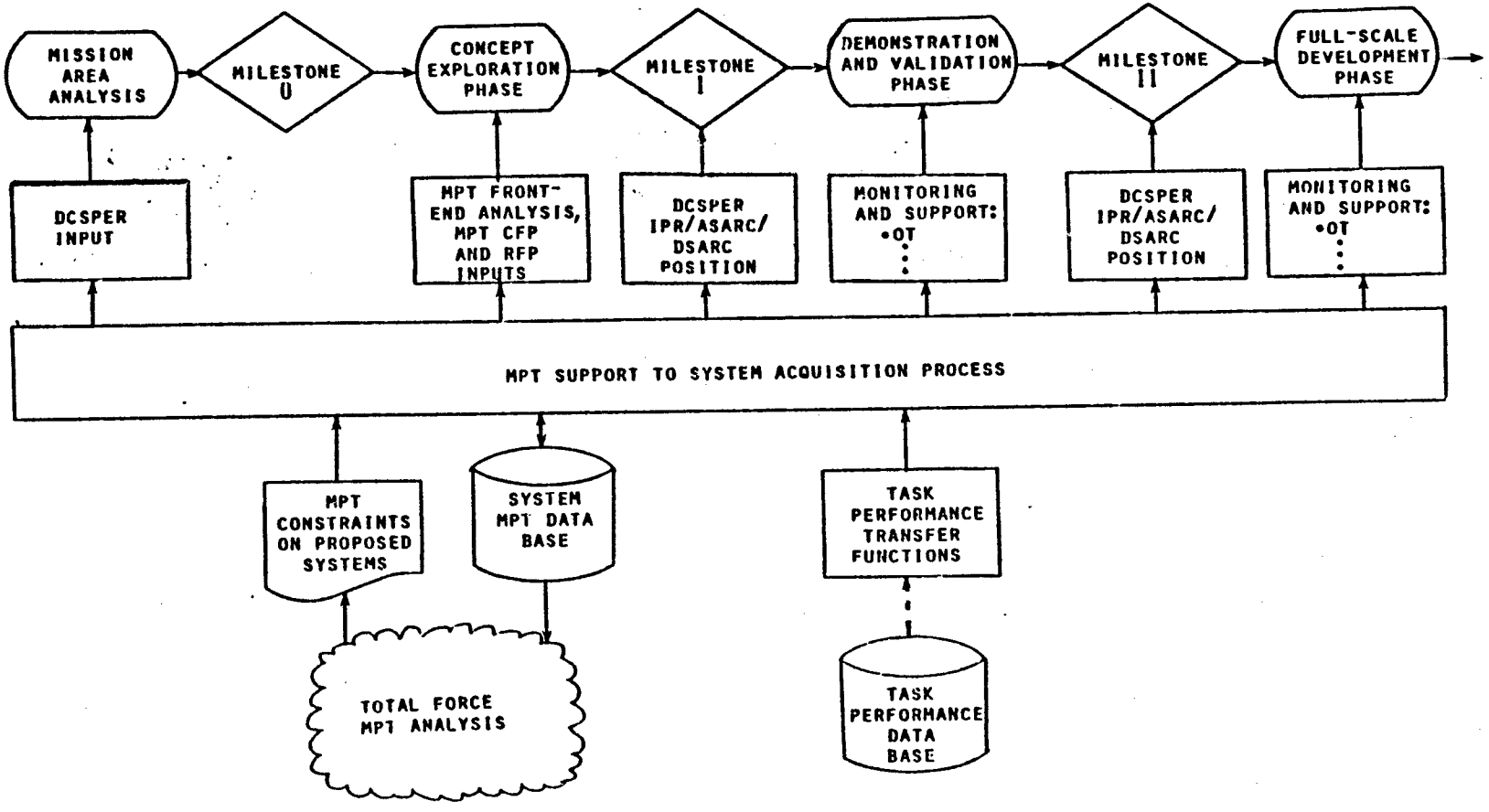
- IF A MATCH CANNOT BE ACHIEVED, MODIFY
  - ACCEPTABLE LEVEL OF PERFORMANCE OF THE SYSTEM, OR
  - SCOPE AND COST OF TRAINING, OR
  - SYSTEM DESIGN CONCEPT

  UNTIL TOTAL SYSTEM PERFORMANCE REQUIREMENTS CAN BE MET

The process of conducting system specific man/machine analysis is summarized on this slide. The first part of the system acquisition process (through full scale engineering development) is represented across the top of the slide. MPT support to each of the phases and milestones of the acquisition process is also shown. The nature of this support is described in more detail on the next slide. The most significant part of this proposed MPT support is the MPT front-end analysis in support of concept exploration; this will be described in detail later. MPT constraints on proposed systems are developed during total force MPT analysis and serve as input to the MPT support of the system acquisition process. The system MPT data base (discussed further below) contains data developed during the MPT support to the system acquisition process; these data are also input to the total force MPT analysis. The task performance data base and transfer functions (also discussed below) are intended to provide information concerning tradeoffs among personnel quality, training, and capability to perform tasks associated with operating or maintaining the system under development.

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- PROCESS --



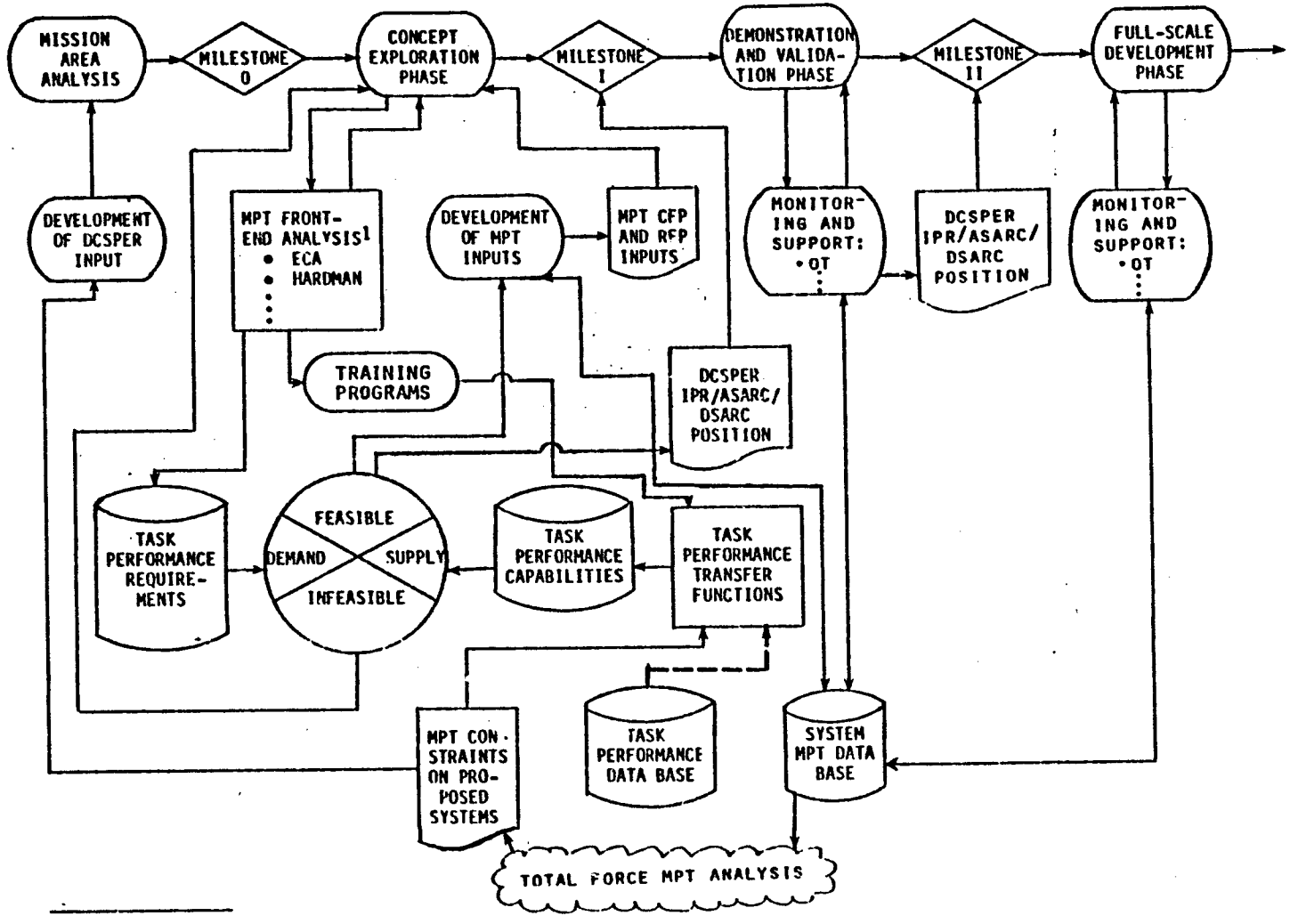
This is a more detailed depiction of the process of conducting system specific man/machine analysis. Detail has been added particularly to the representation of the support of concept exploration. The central feature of this type of support is the comparison between task performance requirements generated by the new system and task performance capabilities of personnel who can be made available to the system. Task performance requirements are determined via MPT front-end analysis involving the use of such already existing tools as Early Comparability Analysis (ECA) and HARDMAN.[1] Task performance capabilities are functions of constraints on the quantity and quality of available personnel and of anticipated training programs. (Anticipated training is determined as part of the MPT front-end analysis.) The task performance transfer functions are used to convert quality and training estimates to estimates of task performance capabilities. If capabilities do not equal requirements, modifications to the concept are called for. If requirements can be met, inputs to the CFP and demonstration and validation RFP are prepared to help assure that task performance requirements will continue to remain feasible.

---

[1]ECA is described in [SSC, undated]. For a description of an application of HARDMAN to an Army system, see [DRC, 1982]. While these tools have limitations, they are the principal methods currently available for MPT front-end analysis and should be used until better techniques can be developed.

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- PROCESS --



[1]ECA PARALLELS AND HARDMAN FOLLOWS

The next several pages discuss the task performance data base and transfer functions. While the task performance data base does not now exist, some data are available which can provide a starting point for development of such a data base. Evolutionary development of the data base is recommended, so that an interim version can be made available as soon as possible. Development of the interim data base should emphasize the assembly of already existing data for systems for which follow-ons are anticipated.

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- TASK PERFORMANCE DATA BASE --

- DATA DESCRIBING TASK PERFORMANCE AS A FUNCTION OF MEASURABLE HUMAN CHARACTERISTICS AND TRAINING

- SHORT TERM SOURCE -- INTERIM TASK PERFORMANCE DATA BASE ASSEMBLED FROM EXISTING AND EMERGING DATA TYING TASK PERFORMANCE TO INDIVIDUAL SOLDIER (AND THUS TO HUMAN CHARACTERISTICS IN EMF, RECRUITING FILES, DMDC DATA, ETC.)

    - DEVELOP FOR SYSTEMS FOR WHICH FOLLOW-ONS ARE ANTICIPATED
    - ASSEMBLE DATA FROM
        - ARI (SQT, PROJECT "A" PRELIMINARY DATA,...)
        - NTC (TRAINING TESTS)
        - OTEA (OPERATIONAL TESTS)
        - CDEC (TACTICS EXPERIMENTS)
        - TRASANA (TEA)

- LONG TERM SOURCE -- ONGOING AND ADDITIONAL RESEARCH EFFORTS BY ARI, SUCH AS THE SYSTEM FOR SELECTION, CLASSIFICATION, AND UTILIZATION OF ENLISTED PERSONNEL (PROJECT "A")

The steps required to develop the interim task performance data base are listed here. To assure that the effort is manageable and will produce useful results in a relatively short time, the first version of the data base should emphasize only critical tasks associated with high priority systems.

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- STEPS IN DEVELOPING TASK PERFORMANCE DATA BASE --

- IDENTIFY HIGH PRIORITY SYSTEMS FOR WHICH FOLLOW-ON IS ANTICIPATED
- IDENTIFY CRITICAL TASKS FOR THESE SYSTEMS
- IDENTIFY AVAILABLE DATA DESCRIBING PERFORMANCE OF THESE TASKS
- DEVELOP DATA BASE STRUCTURE AND FORMAT
- ASSEMBLE AND PROCESS DATA

This table (which is presented on the next five pages) identifies existing systems for which follow-ons are anticipated. Particularly important systems in a cross-section of functional areas have been marked as having highest priority for task performance data collection.

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- IDENTIFICATION OF HIGH PRIORITY SYSTEMS FOR TASK PERFORMANCE DATA BASE --

GENERIC SYSTEM	FIELDED/IN PRODUCTION	IN DEVELOPMENT (PHASE)	CANDIDATE FOLLOW-ON SYSTEMS	
			1990-1995 IOC	1996-2010 IOC
MBT	M60A1/A3, M1*	M1E1 (FSD)	FACS	FCCVS-II
APC/IFV	M113, M2	-	FCCVS-I	FCCVS-II
CFV	M3	-	FCCVS-I	FCCVS-II
LIGHT ARMORED ASSAULT WEAPON	- (FORMERLY M551)	LAV (PROD), MPGS (CE)	-	FCCVS-II
ATGM	M901 ITV	-	LRAT	FCCVS-II
155 MM SP HOW	M109A2/A3*	M109 HELP	MATH P2	-
8" SP HOW	M110A2	M110A2 PIP (BALLISTIC SHELTER) (FSD)	-	M110 FOLLOW-ON
MLRS	MLRS	MLRS PIPS	MLRS TGW	MLRS FOLLOW-ON

-- CONTINUED --

*HIGH PRIORITY FOR TASK PERFORMANCE DATA COLLECTION

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- IDENTIFICATION OF HIGH PRIORITY SYSTEMS FOR TASK PERFORMANCE DATA BASE --

(CONTINUED)

GENERIC SYSTEM	FIELDED/IN PRODUCTION	IN DEVELOPMENT (PHASE)	CANDIDATE FOLLOW-ON SYSTEMS	
			1990-1995 IOC	1996-2010 IOC
FA AMMO SUP VEH	M548, FAASV	-	FAASV PIPS	DSWS DERIVATIVE
CORPS TACTICAL MISSILE SYSTEM	LANCE*	JTACMS (CE)	-	JTACMS FOLLOW-ON
THEATER MISSILE SYSTEM	PERSHING IA	PERSHING II (FSD/INITIAL PROD)	-	PERSHING II FOLLOW-ON
LT AH	AH-1S*	-	LHX	LHX PIPS
HVY AH	AH-64*	-	AH-64 PIPS	AH-64 FOLLOW-ON
SEMA	OV-1D, RV-1D, RF-21, RC-12D, EH-1	JVX (CE) EH-60 (FSD)	EH-60 PIPS	JVX PIPS
AERIAL SCOUT	OH-58C*	AHIP (FSD)	LHX	LHX PIPS

-- CONTINUED --

*HIGH PRIORITY FOR TASK PERFORMANCE DATA COLLECTION

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- IDENTIFICATION OF HIGH PRIORITY SYSTEMS FOR TASK PERFORMANCE DATA BASE --

(CONTINUED)

GENERIC SYSTEM	FIELDED/IN PRODUCTION	IN DEVELOPMENT (PHASE)	CANDIDATE FOLLOW-ON SYSTEMS	
			1990-1995 IOC	1996-2010 IOC
UTILITY HELICOPTER	UH-1, UH-60	UH-60 PIPS (FSD)	UH-60 PIPS, LHX	LHX, UH-60 FOLLOW-ON
CARGO HELICOPTER	CH-47D	-	NEW MLH, HLH	NEW MLH, HLH
AIRBORNE TGT ACQ RADAR	-	JSTARS (CE)	-	JSTARS FOLLOW-ON
RPV	-	AQUILA (FSD)	-	UAV
HIMAD SYSTEMS	I-HAWK, PATRIOT	-	PATRIOT PIPS	PATRIOT FOLLOW-ON
SHORADS SYSTEMS	VULCAN, DIVAD,* STINGER,* ROLAND	STINGER-POST (FSD) LADS (CE)	SHORADS PIPS	FOLLOW-ON SYSTEMS
SHORT RANGE AD C^2 SYSTEM	FAAR, TADDS	SHORADS C^2 (CE)	-	SHORADS C^2 FOLLOW-ON

-- CONTINUED --

*HIGH PRIORITY FOR TASK PERFORMANCE DATA COLLECTION

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- IDENTIFICATION OF HIGH PRIORITY SYSTEMS FOR TASK PERFORMANCE DATA BASE --

(CONTINUED)

GENERIC SYSTEM	FIELDED/IN PRODUCTION	IN DEVELOPMENT (PHASE)	CANDIDATE FOLLOW-ON SYSTEMS	
			1990-1995 IOC	1996-2010 IOC
MULTICHANNEL NETWORK SWITCH	AN/TTC-39 TRI-TAC SWITCH	-	TRI-TAC PIPS	TRI-TAC FOLLOW-ON
SINGLE CHANNEL TACTICAL RADIOS	AN/VRC-12 SERIES, AN/PRC-77, AN/ARC-114	SINGARS (FSD)	-	SINGARS FOLLOW-ON
TACTICAL INFO DISTRIB SYSTEMS	-	JTIDS (FSD)	-	JTIDS FOLLOW-ON
POS LOC AND REPORTING SYS	-	PLRS (FSD)	-	PLRS FOLLOW-ON
INTEGRATED C^2 SYSTEM	-	PLRS/JTIDS HYBRID (FSD)	-	PJH FOLLOW-ON

-- CONTINUED --

*HIGH PRIORITY FOR TASK PERFORMANCE DATA COLLECTION

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- IDENTIFICATION OF HIGH PRIORITY SYSTEMS FOR TASK PERFORMANCE DATA BASE --

(CONCLUDED)

GENERIC SYSTEM	FIELDED/IN PRODUCTION	IN DEVELOPMENT (PHASE)	CANDIDATE FOLLOW-ON SYSTEMS	
			1990-1995 IOC	1996-2010 IOC
GLOBAL POSITIONING SYSTEM	-	NAVSTAR GPS (FSD)	NAVSTAR PIPS	NAVSTAR FOLLOW-ON
MOBILE SUBSCRIBER EQUIPMENT	-	MSE (CE)	-	MSE FOLLOW-ON
INTEGRATED INTELLIGENCE SYSTEM	BETA*, TCAC-D	ASAS (CE)	-	ASAS FOLLOW-ON
ARTILLERY TACTICAL DATA SYSTEM	TACFIRE*	AFATDS (CE)	-	AFATDS FOLLOW-ON
MANEUVER CONTROL SYSTEM	$T(OS)^2$ TESTBED, TCS/TCT*	MCS (CE)	-	MCS FOLLOW-ON

*HIGH PRIORITY FOR TASK PERFORMANCE DATA COLLECTION

The task performance data base, when available, will provide the information necessary to predict task performance levels as functions of personnel quality and training. The resulting "transfer functions" can then be used to convert estimates of available personnel quality and training to estimates of levels at which system operation and maintenance tasks can be expected to be conducted.[1] The graph is a conceptual presentation of such a transfer function in terms of three levels of task performance which can be achieved (designated P_1, P_2, and P_3) with various mixes of personnel quality and training time. Also shown is an example of the kind of quality and training constraints (designated Q_C and T_C) that might be imposed on the development of a system. These constraints limit the task performance level that can be achieved. Where task performance data are unavailable, interim versions of the transfer functions can be based on subject matter expert opinion.

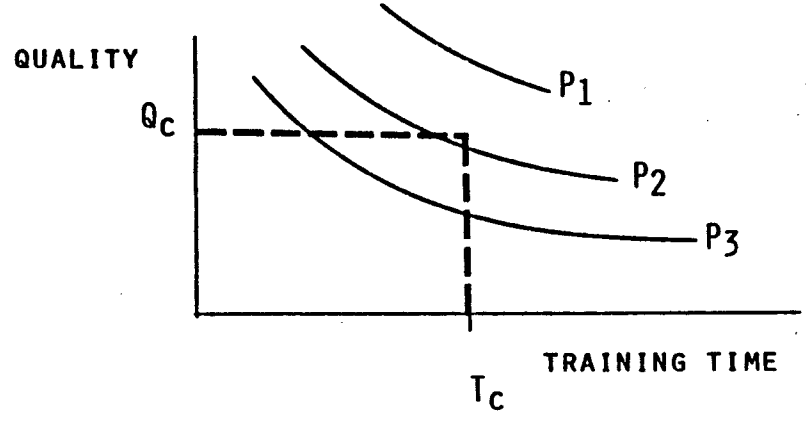
---

[1]The term "transfer function" refers to the result in control theory of mathematically relating the output of a process (in this case, task performance levels) to its inputs (quality and training) without explicitly modeling the process itself. The term is used here in its broadest sense and is not necessarily intended to imply the formal mathematical analysis used to develop transfer functions in control theory.

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- TASK PERFORMANCE TRANSFER FUNCTIONS --

- PURPOSE -- TO PREDICT TASK PERFORMANCE LEVELS FOR INDIVIDUALS AND CREWS



- SHORT TERM SOURCE -- ANALYSIS OF DATA FROM INTERIM TASK PERFORMANCE DATA BASE AND ESTIMATES OF SUBJECT MATTER EXPERTS

- LONG TERM SOURCE -- ONGOING AND ADDITIONAL RESEARCH EFFORTS BY ARI, SUCH AS THE SYSTEM FOR SELECTION, CLASSIFICATION, AND UTILIZATION OF ENLISTED PERSONNEL

Although the motivating reason for developing the task performance data base and transfer functions is for use in the system specific man/machine analysis, such data and functions have several other potential uses, as indicated here.

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- USES OF TASK PERFORMANCE DATA (AND TRANSFER FUNCTIONS) --

IN ADDITION TO USE IN INTEGRATING MPT INTO THE SYSTEM ACQUISITION PROCESS, TASK PERFORMANCE DATA (AND TRANSFER FUNCTIONS) COULD PROVIDE

- INPUT TO COMBAT MODELS
- SELECTION OF PERSONNEL FOR DT/OT
- INPUT TO A NEW READINESS METHODOLOGY
- GUIDELINES FOR SELECTION AND UTILIZATION OF PERSONNEL
- INPUT TO TRAINING DESIGN
-
-
-

As noted earlier, another data base needed for the system specific man/machine analysis is a system MPT data base. Ultimately, such a data base is needed for each system in development and for existing systems as well. In addition to providing information for use with the system specific analysis, summary information from the data base (including estimates of personnel quality requirements) is needed for the total force MPT analysis, as discussed later. Content and some sources for the system MPT data base are noted here. For systems in the early phases of the development process, the MPT front-end analysis also generates some inputs for this data base.

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- SYSTEM MPT DATA BASE --

DETAILED DATA FOR/FROM SYSTEM SPECIFIC ANALYSIS:

- SYSTEM
- PROPONENT
- NUMBER
- PHASING
- PERFORMANCE REQUIREMENTS
- TASK INFORMATION
  - FUNCTION, TASK, AND SUBTASK BREAKDOWN
  - MAN/MACHINE TASK ALLOCATIONS
- MPT REQUIREMENTS
  - NUMBERS
  - MOS
    - SKILLS AND SKILL LEVELS (BY TASK)
    - TRAINING REQUIREMENTS
  - GRADE MIX
  - QUALITY

FOR EXISTING SYSTEMS AND THOSE IN DEVELOPMENT, DATA EXTRACTED FROM REFERENCE DOCUMENTS

- QQPRI
- BOIP
- NETP
-
-
-

Summarized here are methods and data needed to support the system specific man/machine analysis. Near term approaches emphasize the use of existing methods and data, while long term approaches involve ongoing or required new research and development to improve on existing capabilities.

SYSTEM SPECIFIC MAN/MACHINE ANALYSIS

-- METHODS AND DATA --

ITEM	NEAR TERM APPROACH	LONG TERM APPROACH
TASK PERFORMANCE DATA BASE	INTERIM TASK PERFORMANCE DATA BASE AND EXPERT JUDGMENT	ONGOING AND ADDITICNAL RESEARCH EFFORTS BY ARI, SUCH AS THE SYSTEM FOR SELECTION, CLASSIFICATION, AND UTILIZATION OF ENLISTED PERSONNEL
TASK PERFORMANCE TRANSFER FUNCTIONS	ANALYSIS OF INTERIM TASK PERFORMANCE DATA BASE AND EXPERT JUDGMENT	ONGOING AND ADDITIONAL RESEARCH EFFORTS BY ARI, SUCH AS THE SYSTEM FOR SELECTION, CLASSIFICATION, AND UTILIZATION OF ENLISTED PERSONNEL
MPT FRONT-END ANALYSIS	EARLY COMPARABILITY ANALYSIS	EARLY COMPARABILITY ANALYSIS (WITH REFINEMENTS BASED ON INITIAL APPLICATIONS)
	HARDMAN	HARDMAN (WITH IMPROVED EFFICIENCY AND REFINEMENTS BASED ON INITIAL APPLICATIONS)
	OTHER METHODS (E.G., SIMULATION) AS NEEDED	OTHER METHODS AS NEEDED
SYSTEM MPT DATA BASE	HAND ASSEMBLY OF NEEDED DATA	DEVELOPMENT OF A DATA BASE STRUCTURE FOR NEW (CONCEPTUAL) SYSTEMS

We turn now to the implementation structure for total force MPT analysis.

OUTLINE

- BACKGROUND
- SYSTEM SPECIFIC MAN/MACHINE ANALYSIS
- TOTAL FORCE MPT ANALYSIS
- ORGANIZATION AND RESPONSIBILITY
- DEMONSTRATION PROJECT
- SUMMARY AND RECOMMENDATIONS

Total force MPT analysis provides the total force perspective within which individual systems should be considered. The nature of the total force perspective is illustrated here, including a list of alternative classes of MPT reactive, force proactive, and system proactive actions which can be taken to rectify supply/demand problems at the total force level.

TOTAL FORCE MPT ANALYSIS

-- THE TOTAL FORCE PERSPECTIVE --

IN OUTYEAR N THE REQUIREMENT FOR PERSONNEL TO MAN PROGRAMMED SYSTEMS INCLUDES Y THOUSAND SOLDIERS HAVING DESCRIPTION Z. THESE ARE ALLOCATED TO SYSTEMS AS FOLLOWS: ____, ____, ____, ____. IF NEW SYSTEM W IS INTRODUCED A SHORTFALL OF V WILL RESULT. ALTERNATIVE ACTIONS ARE:

1. INCREASE THE NUMBER OF DESCRIPTION Z SOLDIERS (REACTIVE)
2. DELAY IOC OF SYSTEM W UNTIL YEAR N+S WHEN MORE SOLDIERS WITH DESCRIPTION Z WILL BE AVAILABLE (FORCE PROACTIVE)
3. ASSIGN THE SHORTFALL TO OTHER SYSTEMS (FORCE PROACTIVE)
4. IMPOSE CONSTRAINTS ON SYSTEM W (SYSTEM PROACTIVE)
    - MANPOWER (QUANTITY)
    - PERSONNEL (QUALITY)
    - TRAINING (TIME, RESOURCES)

The process for conducting total force MPT analysis is illustrated here. The process is centered on a force-wide comparison of future personnel requirements with projected personnel inventories, each as a function of time, MOS, grade, quality, etc. Projection of future requirements begins with authorization data (PERSACS). These data are adjusted to account for new systems not yet reflected in the PERSACS and to add quality requirements to the data through the use of authorization models and data management systems such as CAUDB and (ultimately) the Personnel Authorizations Module (PAM) of the FORECAST system.[1] Providing additional information to this process is an aggregate systems data base summarizing the qualitative and quantitative personnel requirements specified in the system MPT data bases for all new systems. Requirements for "overhead" personnel (those who are not members of units but are either transients, trainees, holdees, or students -- TTHS) must be added to the projected authorizations to generate total personnel requirements. Projections using historical TTHS data can be used for this purpose, although the FORECAST Individual Accounts Module will eventually provide more accurate projections.

On the supply side, projection of future personnel inventories begins with assumptions about current and future policies and activities of the Army manning system (numbers of recruiters, pay and

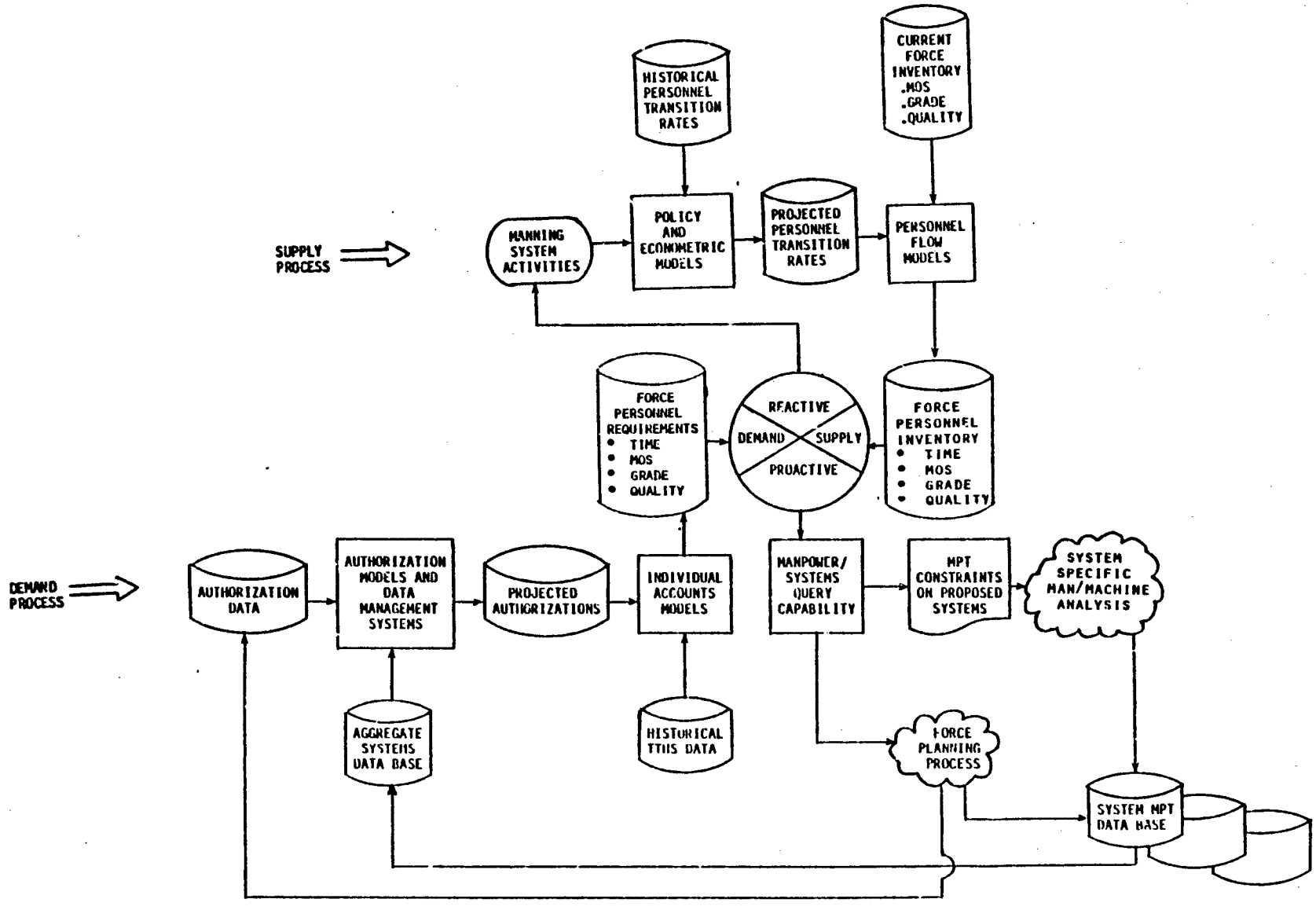
-- Continued --

---

[1]For a summary description of the FORECAST system, see [US Army, 1983].

TOTAL FORCE MPT ANALYSIS

-- PROCESS --



allowances levels, bonus structures, retirement benefits, etc.). Policy and econometric models allow projecting, as a function of these activities, rates at which personnel will flow into the Army, migrate among statuses (MOS, grades, etc.) within the Army, and ultimately separate from the Army. (In the short term, subjective judgment can be used to predict changes to historical values of these transition rates as a partial substitute for the currently incomplete set of policy and econometric models). Given a set of these projected transition rates and a current mix of personnel in the Army, personnel flow models such as used in the Army Personnl Planning System (APPS) [VRI, 1983] can generate the required estimates of future personnel inventories.

As noted earlier, if inventories do not match requirements, various reactive actions (changes to the projected activities of the manning system) and/or proactive actions (affecting the force planning process or establishing MPT constraints as input to the system specific man/machine analysis) can be taken. Proactive actions require the use of a "manpower/systems query capability" to identify those systems driving the personnel requirements that cannot be met. This is discussed further on the next slide.

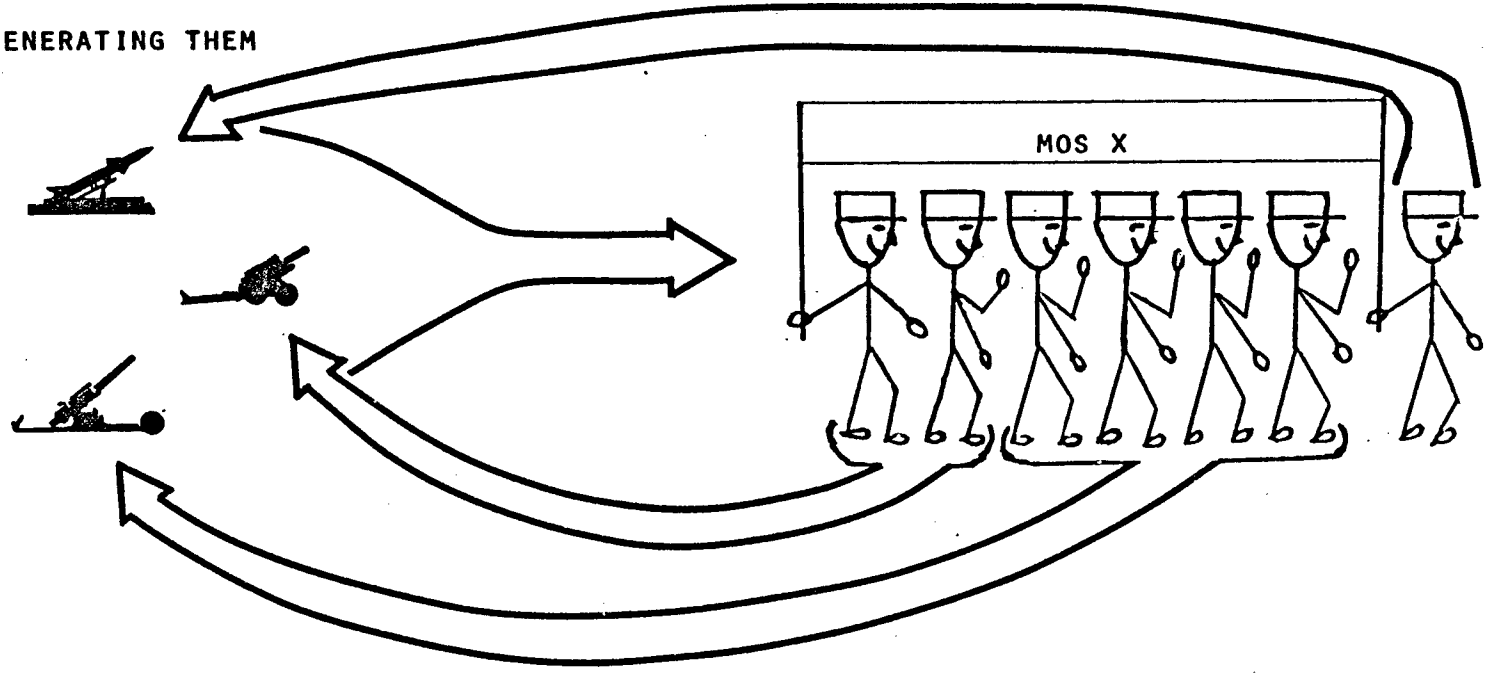
THIS PAGE INTENTIONALLY LEFT BLANK

The PERSACS and associated authorizations models and data management systems generate total manpower requirements (by MOS and other descriptors) from a specified set of systems and structure. (This is illustrated by the arrow pointing to the right in the figure.) However, these models and systems do not allow reversing the process; i.e., they do not allow identifying the number of individuals in a particular MOS who are associated with a particular existing or proposed system (the capability illustrated by the arrows pointing to the left). This "system attributable requirements for manpower" (SARM) data management capability is needed to guide the development of proactive options within the total force MPT analysis.

TOTAL FORCE MPT ANALYSIS

-- MANPOWER/SYSTEMS QUERY CAPABILITY --

CURRENT AND PROPOSED AUTHORIZATIONS MODELS AND DATA SYSTEMS (CAUDB/PMAD, FORECAST PAM) DO NOT HAVE CAPABILITY TO RELATE MANPOWER REQUIREMENTS TO THE MATERIEL SYSTEMS GENERATING THEM



BECAUSE THIS CAPABILITY IS NEEDED FOR DEVELOPMENT OF FORCE PROACTIVE OPTIONS AND PROACTIVE MPT CONSTRAINTS ON PROPOSED SYSTEMS, A NEW "SYSTEM ATTRIBUTABLE REQUIREMENTS FOR MANPOWER" (SARM) DATA MANAGEMENT SYSTEM SHOULD BE DEVELOPED WHICH ALLOWS TRACING MANPOWER REQUIREMENTS TO THE SYSTEMS DRIVING THEM

Summarized here are methods and data needed to support the total force MPT analysis. Near term approaches emphasize the use of existing methods and data, while long term approaches involve ongoing or required new research and development to improve on existing capabilities. While little of this type of analysis has been done in the past, existing methods and data provide a rudimentary capability which can eventually evolve into a more comprehensive approach to conducting total force MPT analyses.

TOTAL FORCE MPT ANALYSIS

-- METHODS AND DATA --

ITEM	NEAR TERM APPROACH	LONG TERM APPROACH
HISTORICAL PERSONNEL TRANSITION RATES	ARMY PERSONNEL PLANNING SYSTEM (APPS)	PROCESSING OF EMF AND RELATED DATA WITHIN FORECAST SYSTEM
POLICY AND ECONOMETRIC MODELS	EXISTING MODELS AND SUBJECTIVE JUDGEMENT PREDICTING CHANGES TO HISTORICAL TRANSITION RATES	RESULTS OF CURRENT MODELING EFFORTS
PERSONNEL FLOW MODELS	APPS	ARMY PERSONNEL PLANNING SYSTEM OR FORECAST
AUTHORIZATION DATA	PERSACS	IMPROVED PERSACS
AGGREGATE SYSTEMS DATA BASE	HAND ASSEMBLY OF NEEDED DATA (BOIP, QQPRI, PEM, ETC.)	DEVELOPMENT OF NEW DATA BASE
AUTHORIZATION MODELS AND DATA MANAGEMENT SYSTEMS	CAUDB/PMAD PROCESS	FORECAST PAM
HISTORICAL TTHS DATA	MILPERCEN DATA	MILPERCEN DATA
INDIVIDUAL ACCOUNTS MODELS	PROJECTION OF HISTORICAL DATA	FORECAST INDIVIDUAL ACCOUNTS MODULE
MANPOWER/SYSTEMS QUERY CAPABILITY	HAND PROCESSING TO IDENTIFY SYSTEMS DRIVING MANPOWER REQUIREMENTS	SARM DATA MANAGEMENT SYSTEM

The following pages identify the organizations and individuals that should conduct and support the types of analyses described earlier, delineate the responsibilities of these organizations and individuals, and describe how they should interact to assure that MPT considerations are properly accounted for in the system acquisition process.

OUTLINE

- BACKGROUND
- SYSTEM SPECIFIC MAN/MACHINE ANALYSIS
- TOTAL FORCE MPT ANALYSIS
- ORGANIZATION AND RESPONSIBILITY
- DEMONSTRATION PROJECT
- SUMMARY AND RECOMMENDATIONS

Several guidelines were used in identifying organizational structures and responsibilities for the implementation structure. First, to the extent possible, the MPT integration should be accomplished within existing regulations and organizational roles in order to assure that the implementation is bureaucratically feasible within a reasonable time frame. Secondly, because MPT expertise is currently in short supply within the Army, it should be used as efficiently as possible and focused on the most critical areas. The third and fourth guidelines suggest that the required analyses should not be fragmented; i.e., that conduct of system specific and total force analyses should be integrated, and that, for either type of analysis, supply and demand considerations should be integrated.

ORGANIZATION AND RESPONSIBILITY

-- GUIDELINES --

PERFORM MPT INTEGRATION WITHIN EXISTING AR AND ORGANIZATIONAL ROLES

USE AND FOCUS SCARCE MPT EXPERTISE EFFICIENTLY

INTEGRATE CONSIDERATION OF SYSTEM MPT ISSUES AND THE TOTAL FORCE PERSPECTIVE

INTEGRATE CONSIDERATION OF MPT REQUIREMENTS AND SUPPLY (TOTAL FORCE AND SYSTEM SPECIFIC)

Existing lines of communication within the system acquisition process involve interactions of the various TRADOC representatives (the TSM, TRASSO, and TISO) with the DALSO for support from the DCSLOG, the DASC for funding from the DCSRDA, the PM within DARCOM for building the system and training devices, and the FISO for distribution of the system and training policy from the DCSOPS.[1] Improved integration of MPT into these lines of communication requires the addition of the following:

(1) communication with the newly-created PERSSO to provide personnel policies from the DCSPER; and

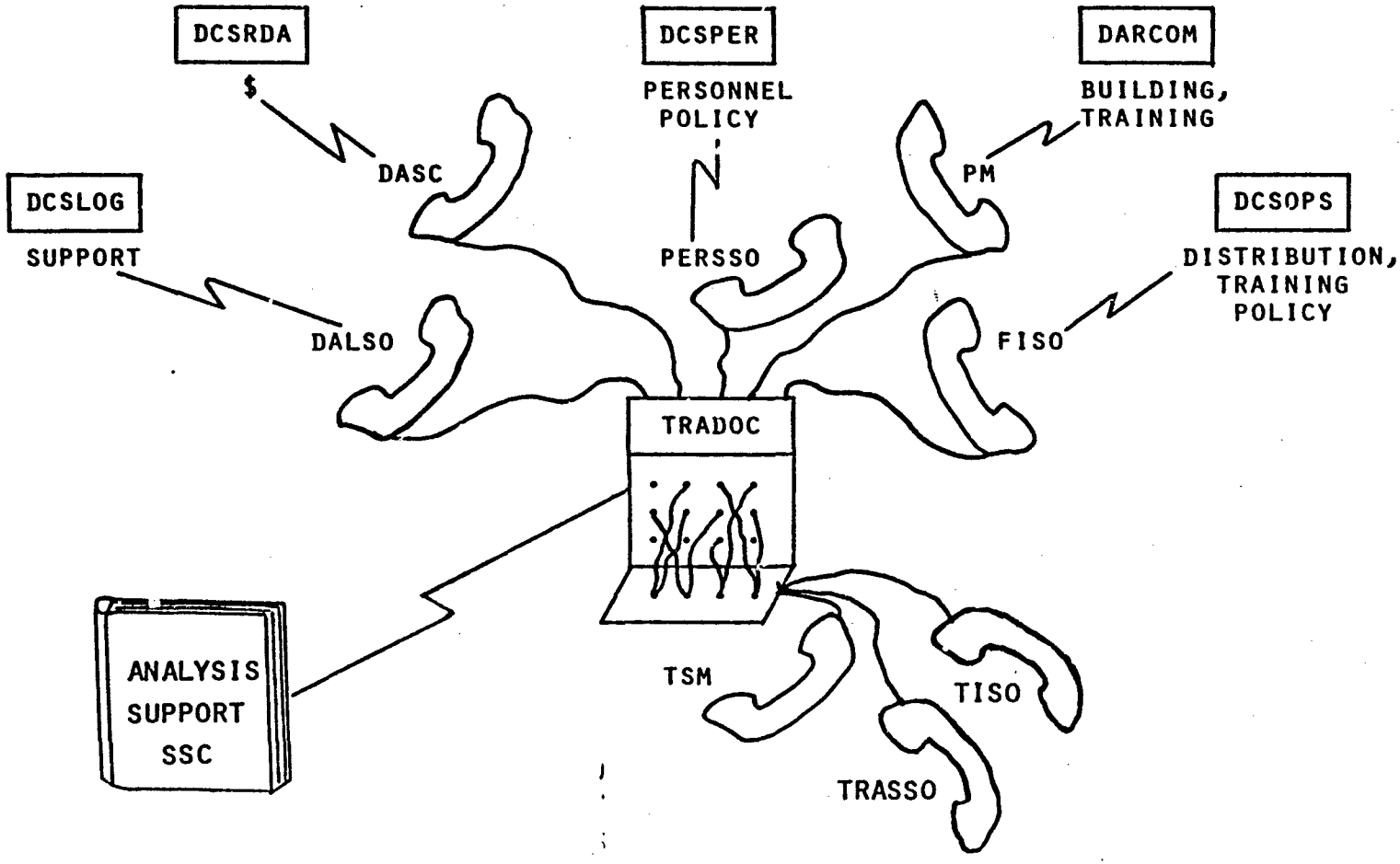
(2) provision of analysis support of the types described earlier in this report, to be conducted by the Soldier Support Center (National Capital Region) in support of the TSM or other representative of the proponent.

---

[1]Not included on the slide are interactions involving Reserve and National Guard components.

ORGANIZATION AND RESPONSIBILITY

-- LINES OF COMMUNICATION --



This slide depicts a recommended organizational structure and responsibilities for developing and applying MPT analysis methods in support of the system acquisition process. Both system specific and total force analyses are to be conducted by a new Analysis Directorate within the Personnel Integration Center (PIC) of the Soldier Support Center (SSC). The two divisions of the directorate will be responsible for total force analysis and system specific analysis, respectively. Within each division, one branch will be responsible for requirements determination (demand) and another for requirements supportability (supply). Recommended staff sizes within the directorate are noted in parentheses.[1]

The Army Research Institute (ARI) will support the Analysis Directorate with the development of new methods and data bases as needed.

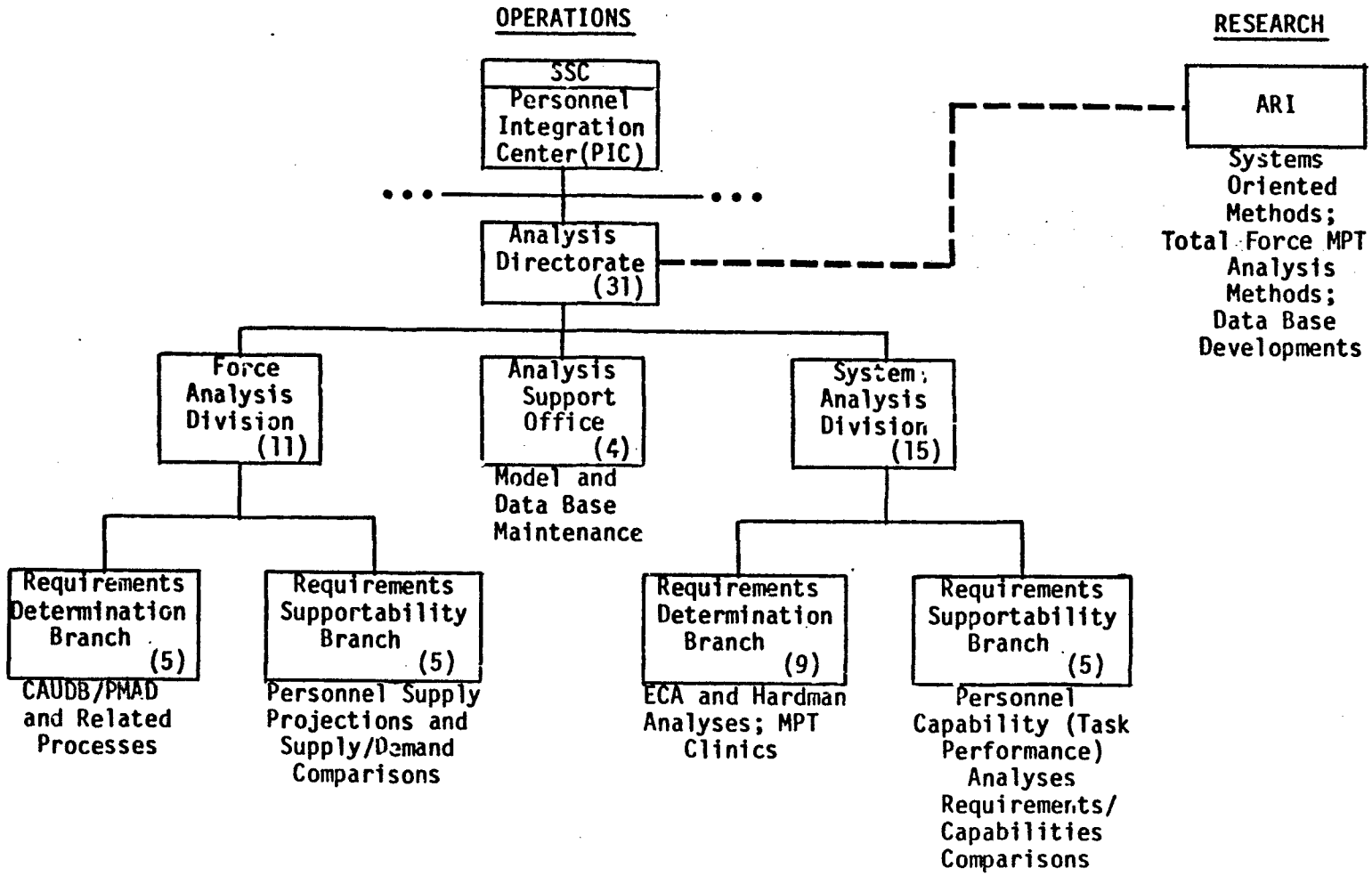
Within the System Analysis Division of the Analysis Directorate, MPT front-end analyses and related work will be conducted through the use of "MPT clinics," which are described on the next slide.

---

[1]SSC may wish to increase these staff sizes to allow for administrative and additional technical functions.

ORGANIZATION AND RESPONSIBILITY

-- ORGANIZATIONAL STRUCTURE --



The concept of MPT clinics is outlined here. It provides a means for efficient use of scarce MPT expertise within the Army.

ORGANIZATION AND RESPONSIBILITY

-- MPT CLINICS --

AN APPROACH FOR USING SCARCE MPT EXPERTISE IN THE SYSTEMS ACQUISITION PROCESS

- ASSIST TSM AND/OR STF/SSG IN PLANNING AND EXERCISING THEIR MPT RESPONSIBILITIES, INCLUDING
  - DEVELOPING REQUIREMENTS FOR PERSONNEL (VIA ECA, HARDMAN, ETC.)
  - APPLYING MPT CONSTRAINTS
  - APPLYING TASK PERFORMANCE TRANSFER FUNCTIONS
- CONSIST OF
  - METHODOLOGY EXPERTS (HARDMAN, ECA, TRANSFER FUNCTIONS, ETC.)
  - MPT SUBJECT MATTER EXPERTS (WHO CAN PROVIDE SUBJECTIVE ESTIMATES WHERE HARD DATA ARE UNAVAILABLE)
- TASK ORGANIZED FOR SPECIFIC APPLICATIONS
  - IN NEAR TERM, DRAWN FROM EXISTING ORGANIZATIONS ON TDY BASIS UNDER PIC SUPERVISION
  - IN LONG TERM, ORGANIZED FROM PIC STAFF

The DCSPER's new Personnel System Staff Officer (PERSSO) will also participate in the improved integration of MPT into the system acquisition process. In addition to his other duties, he should be responsible for the functions shown here. In carrying out these functions, he will receive analysis support from the Personnel Integration Center.

ORGANIZATION AND RESPONSIBILITY

-- RESPONSIBILITIES OF PERSSO --

- SERVES AS ODCSPER POC FOR SUPPORT OF MPT ANALYSES PERFORMED BY THE PIC
- PRESENTS TOTAL FORCE PERSPECTIVE AND COORDINATES MPT SUPPORT TO MAA SAG
- PREPARES DCSPER IPR/ASARC/DSARC POSITIONS
- PREPARES AND PERIODICALLY UPDATES OVERALL MPT STATUS FOR USE BY DCSPER (E.G., A PERSONNEL "GREEN BOOK")

Responsibilities of the proponent (represented by the TSM, TSM designate, or other TRADOC representative) in contributing to this process are outlined here. The Personnel Integration Center will provide analysis support to assist in carrying out these responsibilities.

ORGANIZATION AND RESPONSIBILITY

-- RESPONSIBILITIES OF PROPONENT --

- DESIGNATES DEPUTY TO CHAIRMAN OF STF/SSG
- REQUESTS SUPPORT OF AN MPT CLINIC
- INITIATES ECA
- COORDINATES ECA RESULTS WITH DEVELOPER
- ADVISES STF/SSG ON MPT ISSUES SURFACED BY ECA
- INITIATES HARDMAN
- ASSURES HARDMAN RESULTS ARE COORDINATED WITH COEA, BTA, TOD, TOA, LSA, AND PQA
- COORDINATES DEVELOPMENT OF MPT PORTION OF RFP FOR DEMONSTRATION AND VALIDATION PHASE; COORDINATES PREPARATION AND EXECUTION OF MPT SOURCE SELECTION CRITERIA
- MONITORS CONTRACTOR PERFORMANCE OF MPT ANALYSES
- COORDINATES MPT IN DESIGN OF DT/OT
- COORDINATES MPT PORTION OF FSED RFP; COORDINATES PREPARATION AND EXECUTION OF MPT SOURCE SELECTION CRITERIA
- MONITORS MPT ANALYSIS AND TESTING DURING FSED AND BEYOND

In addition to the responsibilities of the Analysis Directorate (outlined earlier), the Personnel Integration Center will have the responsibilities listed here.

ORGANIZATION AND RESPONSIBILITY

-- ADDITIONAL RESPONSIBILITIES OF PIC --

- PROVIDES MPT SUPPORT TO MAA SAG
- PREPARES MPT INPUTS TO CFP
- REVIEWS MPT PORTION OF RFP FOR DEMONSTRATION AND VALIDATION PHASE; REVIEWS AND ASSISTS IN EXECUTION OF MPT SOURCE SELECTION CRITERIA
- PROVIDES INPUT SUPPORT TO DT/OT AND REVIEWS RESULTS
- REVIEWS MPT PORTION OF FSED RFP; REVIEWS AND ASSISTS IN EXECUTION OF MPT SOURCE SELECTION CRITERIA
- PROVIDES ADDITIONAL ANALYSIS SUPPORT TO PROPONENT AND PERSSO AS NEEDED

The following pages describe a project designed to demonstrate the implementation structure.

OUTLINE

- BACKGROUND
- SYSTEM SPECIFIC MAN/MACHINE ANALYSIS
- TOTAL FORCE MPT ANALYSIS
- ORGANIZATION AND RESPONSIBILITY
- DEMONSTRATION PROJECT
- SUMMARY AND RECOMMENDATIONS

The primary objective of the recommended demonstration project is to exercise the implementation structure in the context of an actual system acquisition. A secondary objective is to benefit the selected system by assisting in the integration of MPT considerations into its development. While the quality of the results of this exercise will be somewhat limited by existing methods and data, the system should benefit from a logically-structured evaluation of its MPT needs. The Mobile Protected Gun System (MPGS) has been identified as an appropriate system for the demonstration project.

DEMONSTRATION PROJECT

-- OBJECTIVES --

- EXERCISE IMPLEMENTATION STRUCTURE
  - DETERMINE FEASIBILITY
  - SHAKE DOWN CLINIC CONCEPT
  - IDENTIFY PROBLEM AREAS
  - ASSESS COSTS
  - DEMONSTRATE USEFULNESS
- ASSIST IN INTEGRATING MPT CONSIDERATIONS INTO DEVELOPMENT OF A SYSTEM CURRENTLY IN THE CONCEPT EXPLORATION PHASE -- THE MOBILE PROTECTED GUN SYSTEM (MPGS)
  - INTEGRATE MPT FRONT-END ANALYSIS RESULTS INTO THE CONCEPT FORMULATION PACKAGE
  - ENSURE ADVANCED DEVELOPMENT RFP SPECIFIES
    - QUANTITY AND QUALITY CONSTRAINTS ON PERSONNEL TO BE EXPLICIT IN TOD
    - REQUIREMENT TO DEFINE SPECIFIC MPT ISSUES TO BE EVALUATED IN DT/OT
  - DEVELOP PLAN FOR REVIEW OF PROPOSALS TO EVALUATE CONTRACTOR APPROACH TO MPT/HARDWARE DESIGN/SYSTEM PERFORMANCE TRADEOFFS

Reasons for selection of MPGS for the demonstration project are listed here.

DEMONSTRATION PROJECT

-- WHY MPGS? --

- SYSTEM IS STILL IN CONCEPT EXPLORATION PHASE; CONCEPT FORMULATION PACKAGE NOT YET PUT TOGETHER

- THERE MAY BE NO FSED PHASE; THIS ABBREVIATED SCHEDULE IMPLIES THAT MPT PLANNING MUST BE DONE EARLY

- PM AGREES THAT IT IS IMPORTANT FOR THE MPT COMMUNITY TO BECOME MORE HEAVILY INVOLVED WITH THE MPGS PROGRAM

The overall approach to the demonstration project is outlined here. The project will use existing tools and data and will fill in information gaps (task performance transfer functions, long-range projections of future total force manpower requirements, etc.) using estimates from subject matter experts. The next several slides provide additional details of the approach.

DEMONSTRATION PROJECT

-- APPROACH --

- STRUCTURE ALTERNATIVE GENERIC MPGS SYSTEM CONFIGURATIONS
- PERFORM EARLY COMPARABILITY ANALYSIS (ECA) ON THESE CONFIGURATIONS IN PARALLEL WITH CONCEPT EXPLORATION STUDIES
- CONDUCT HARDMAN APPLICATION ON SYSTEM CONCEPTS GENERATED BY CONCEPT EXPLORATION STUDIES, USING ECA RESULTS TO FOCUS EFFORT ON MOST SIGNIFICANT POTENTIAL MPT PROBLEMS
- PERFORM TOTAL FORCE MPT ANALYSIS TO DETERMINE SUPPORTABILITY OF MPGS REQUIREMENTS IN THE CONTEXT OF COMPETING DEMANDS GENERATED BY OTHER SYSTEMS
- INCORPORATE RESULTS OF MPT ANALYSIS INTO
  - CONCEPT FORMULATION PACKAGE VIA TOA, TOD, BTA
  - RFP FOR DEMONSTRATION AND VALIDATION PHASE
  - MPT BOILERPLATE FOR M/ASARC I

The first major technique to be used in the demonstration project is Early Comparability Analysis on alternative generic MPGS system configurations. (As described on the next two slides, preliminary identification of these generic configurations has been completed.)

DEMONSTRATION PROJECT

-- EARLY COMPARABILITY ANALYSIS --

- PRELIMINARY IDENTIFICATION OF GENERIC MPGS CONFIGURATIONS HAS BEEN COMPLETED
- ECA SHOULD BEGIN AS SOON AS POSSIBLE
- MPT CLINIC APPROACH SHOULD BE USED
- TEAM SHOULD
  - BE LED BY A REPRESENTATIVE OF SSC-NCR KNOWLEDGEABLE IN ECA METHODOLOGY
  - CONSIST OF FOUR MEMBERS
  - BE ASSIGNED ON TDY STATUS FROM
    - ARI
    - TRADOC SCHOOLS RESPONSIBLE FOR TRAINING IN APPROPRIATE MOS
    - OTHER ORGANIZATIONS AS APPROPRIATE (ARMOR/ENGINEER BOARD, INFANTRY BOARD, TECOM, OTEA, ABRAMS TANK AND BRADLEY FV TSM OFFICES, MARINE CORPS, ETC.)

ECA involves analysis of subsystems of existing systems which are sufficiently similar to the proposed system that they can be used in assessing task performance requirements for the proposed system. Systems which may provide predecessor subsystems for the MPGS are noted here.

DEMONSTRATION PROJECT

-- STRUCTURING ALTERNATIVE GENERIC MPGS SYSTEM CONFIGURATIONS --

- SYSTEMS CONSIDERED FOR SOURCES OF INFORMATION ON GENERIC PREDECESSOR SUBSYSTEMS:
  - M113 FAMILY
  - BRADLEY FIGHTING VEHICLES
  - M551
  - M1 ABRAMS TANK
  - M60A1/A3 TANK
  - LAV-25
  - CADILLAC-GAGE COMMANDO SERIES WHEELED COMBAT VEHICLES
  - M901 ITV
  - •
  - •
  - •
- ALTERNATIVE GENERIC SYSTEMS HAVE BEEN CONFIGURED FOR VARIOUS COMBINATIONS OF SUBSYSTEMS OF PREDECESSOR SYSTEMS

For each potential variant of the major MPGS subsystems, this table lists possible predecessor systems, associated MOS, and tasks which are potential "high drivers." The table provides input to the ECA process as applied to MPGS.

DEMONSTRATION PROJECT

-- GENERIC MPGS SUBSYSTEMS AND VARIANTS OF EACH --

SUBSYSTEM	VARIANT	PREDECESSOR SYSTEMS	MOS INVOLVED			POTENTIAL "HIGH DRIVER"
			OPERATOR	MAINTAINER	REPAIRER	
CHASSIS/ AUTOMOTIVE	Tracked	M113, M551, M2/M3, HSTVL	11M, 19D	63T	63G, 63H	Maintenance of track
	Wheeled	LAV, Cadillac Gage Commando Armored Car	___[2]	63S	63G, 63H, 63S	Maintenance of drive train
BALLISTIC PROTECTION	"Standard" Light Armor	M113, M2/M3, M551	NA	63T	63H	Repair of damage to armor; replacement of torsion bar anchors
	Applique Armor	TOW Cap (Pintle Mounted TOW on M113 Carrier w/ KEVLAR "cap")	___[3]	63T	63H	Above plus removing, stowing, and replacing applique
ARMAMENT	Cannon (75-105mm)	M60A1/A3, M1, HSTVL, HIMAG, PACCAR Elevated Gun	19E, 19K	45E	41C, 45G, 45K	Gunner tasks, training, skill decay, etc.; turret (armament and fire control) maintenance
	MPMS[1]	ITV, STINGER	11H, 16S	45T	27E, 45K	Same as above
	Cannon and MPMS	M60A2, M551, M2/M3	11H, 19D	45E, 45T	27E, 41C, 45G, 45K	Same as above

[1]Multi-purpose (antiarmor/AD) missile system for use against both ground combat vehicles and helicopters.

[2]There is no MOS in AR 611-201 for wheeled armored combat vehicle crewman. There probably will be a new MOS for LAV-25 crewman. MOS 11M and 19D would most likely involve skills needed to operate a wheeled armored combat vehicle.

[3]This would be a new task. Some insight might be gained by reviewing experience with TOW "cap" vehicle.

The second major technique to be employed in the demonstration project is HARDMAN analysis of MPGS.

DEMONSTRATION PROJECT

-- HARDMAN ANALYSIS --

- MPT CLINIC APPROACH SHOULD BE USED
- TEAM SHOULD
  - BE LED BY HARDMAN EXPERT
  - CONSIST OF FOUR TO SIX MEMBERS
  - INCLUDE SUBJECT MATTER EXPERTS ASSIGNED ON TDY STATUS
- APPLICATION SHOULD BE PLANNED WELL AHEAD OF INITIATION
  - STRUCTURE EFFORT BASED ON ECA RESULTS
  - IDENTIFY DATA SOURCES AND ASSEMBLE DATA
  - SELECT CLINIC MEMBERS
  - ARRANGE FOR ACCESS TO DATA, CONCEPT DESIGNERS, AND SUBJECT MATTER EXPERTS

The ECA and HARDMAN analyses of MPGS will contribute to the needed MPT front-end analysis to help identify the MPT requirements of the system. A total force MPT analysis will also be conducted to establish MPT constraints for use in determining the supportability of these requirements.

DEMONSTRATION PROJECT

-- TOTAL FORCE MPT ANALYSIS --

- USE ARMY PERSONNEL PLANNING SYSTEM (APPS) TO DETERMINE SUPPORTABILITY OF COMPETING REQUIREMENTS IN TIME FRAME OF MPGS INTRODUCTION (FY92 AND BEYOND)
  - PROJECT FUTURE PERSONNEL TRANSITION RATES
  - DETERMINE ASSOCIATED FUTURE PERSONNEL INVENTORIES
  - USE CAUDB/PMAD PROCESS TO UPDATE FUTURE PERSONNEL REQUIREMENTS
  - COMPARE PROJECTED INVENTORIES WITH REQUIREMENTS TO IDENTIFY PROBLEM AREAS
  - EXPERIMENT WITH APPS TO EXAMINE IMPACTS OF ALTERNATIVE MPT CONSTRAINTS DESIGNED TO RESOLVE PROBLEM AREAS

- PERFORM SIDE ANALYSES TO DEVELOP MORE DETAILED PROJECTIONS AND ASSOCIATED MPT CONSTRAINTS FOR MOS ASSOCIATED WITH EACH VARIANT OF MPGS GENERIC SUBSYSTEMS

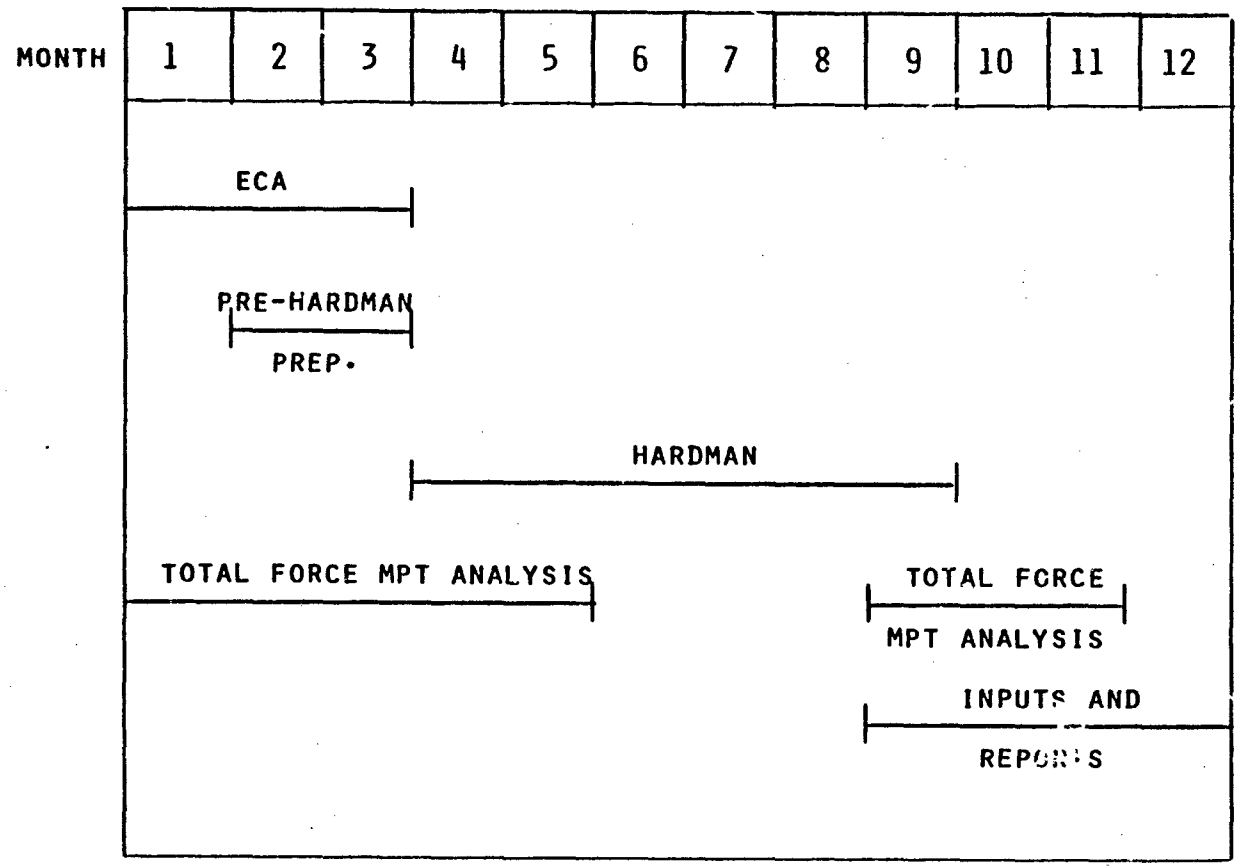
This chart indicates an anticipated schedule for completion of the demonstration project. A 12-month project is envisioned. The total force analysis is divided into two segments to allow for (1) development of MPT constraints as input to HARDMAN and the associated supply/demand comparisons; and (2) assessment of the total force impact of MPGS following completion of the HARDMAN analysis.[1]

---

[1]It should be noted that future total force analyses for other systems following this inital application should require less time than is needed to perform the analysis this first time.

DEMONSTRATION PROJECT

-- SCHEDULE --



Personnel resources required to perform the demonstration project are estimated here.[1]

[1]Future total force analyses for other systems following this initial application will require less effort than is needed to perform the analysis this first time.

DEMONSTRATION PROJECT

-- ESTIMATED RESOURCES --

TASK	PERSON MONTHS
EARLY COMPARABILITY ANALYSIS	12
HARDMAN ANALYSIS (INCLUDING PRE-HARDMAN PREPARATION)	24
TOTAL FORCE MPT ANALYSIS	32
DEVELOPMENT OF MPT INPUTS TO CFP, RFP, M/ASARC	16
TOTAL	84

The report concludes with a summary and statement of recommendations.

OUTLINE

- BACKGROUND
- SYSTEM SPECIFIC MAN/MACHINE ANALYSIS
- TOTAL FORCE MPT ANALYSIS
- ORGANIZATION AND RESPONSIBILITY
- DEMONSTRATION PROJECT
- → SUMMARY AND RECOMMENDATIONS

Major issues addressed in this report are noted here. The implementation structure described here is needed and can be made to work if it is given sufficiently high priority.

SUMMARY AND RECOMMENDATIONS

-- MAJOR ISSUES --

- IS ACTION NECESSARY? ...ABSOLUTELY
- IS THE CONCEPT WORKABLE? ...NEED DEMONSTRATION PROJECT
- IS ORGANIZATIONAL APPROACH SOUND? ...IT ASSIGNS RESPONSIBILITY TO ORGANIZATIONS ALREADY RESPONSIBLE AND TRYING TO EXECUTE
- WHAT ARE THE MAIN PROBLEMS?
  - EVOLUTIONARY DEVELOPMENT OF NEEDED TOOLS (TASK PERFORMANCE DATA BASE AND TRANSFER FUNCTIONS, SARM DATA MANAGEMENT SYSTEM, HARDMAN AND ECA REFINEMENTS, SYSTEM SIMULATION MODELS, ETC.)
  - TRAINING KEY PERSONNEL IN THE OBJECTIVES AND PROCEDURES
  - GAINING THE CONFIDENCE OF THE DEVELOPMENT COMMUNITY

Administrative steps leading to adoption of the implementation structure are recommended here.

SUMMARY AND RECOMMENDATIONS

-- ADMINISTRATIVE RECOMMENDATIONS --

- ARI AND SSC-NCR APPROVE THE IMPLEMENTATION STRUCTURE AND THE DEMONSTRATION PROJECT
- THIS BRIEFING BE GIVEN TO THE DCSPER AS SOON AS POSSIBLE
- DCSPER APPROVE PRESENTATION OF THIS BRIEFING TO TRADOC, DARCOM, AND ELEMENTS OF THE ARMY STAFF (DCSOPS, DCSRDA, DCSLOG, ETC.)
- AFTER THIS COORDINATION, DCSPER SUBMIT A DRAFT CSM TO OCS WHICH DIRECTS ADOPTION OF THE PROPOSALS IN TWO STAGES
  - DEMONSTRATION PROJECT
  - FULL IMPLEMENTATION

Finally, this slide lists substantive recommendations and estimates of associated resource requirements. (Some of the estimates have been left blank pending ARI's assessment of how the recommended research will be integrated with the Institute's other activities.)

SUMMARY AND RECOMMENDATIONS

-- PROCESS RECOMMENDATIONS --

- TRADOC ADOPT THE IMPLEMENTATION STRUCTURE
  - SPECIFIC TYPES OF ANALYSES AND THEIR RELATION TO ACQUISITION PROCESS
  - SPECIFIC MEANS AND METHODS (E.G., CLINICS, ECA)
  - ORGANIZATION AND RESPONSIBILITIES

  TRADOC RESOURCE THE ANALYSIS DIRECTORATE OF THE PIC (31+ PERSONS)

- SSC CONDUCT DEMONSTRATION PROJECT USING THE MPGS (84 PERSON MONTHS)

- ARI INITIATE EVOLUTIONARY DEVELOPMENT OF TASK PERFORMANCE DATA BASE IMMEDIATELY (DCSPER RESOURCE WITH _____ PERSONS)

- USING PERSACS AND CAUDB AS A STARTING POINT, SSC/ARI DEVELOP THE DATA AND THE APPLICATIONS SOFTWARE FOR THE SARM DATA MANAGEMENT SYSTEM (DCSPER RESOURCE WITH _____ PERSONS). COMPLETE INITIAL VERSION FOR SELECTED MOS IN 6 TO 9 MONTHS

- ARI CONTINUE, AND PLACE HIGH PRIORITY ON, THE DEVELOPMENT OF METHODS AND DATA TO SUPPORT THE MPT ANALYSES (E.G., HARDMAN AND ECA REFINEMENTS, TASK PERFORMANCE TRANSFER FUNCTIONS, SYSTEM SIMULATION MODELS) (DCSPER RESOURCE WITH _____ PERSONS)

THIS PAGE INTENTIONALLY LEFT BLANK

REFERENCES

[DePuy and Bonder, 1982]

DePuy, William E., and Bonder, Seth, Integration of MPT Supply and Demand and the System Acquisition Process, Research Note 82-16, Systems Research Laboratory, US Army Research Institute for the Behavioral and Social Sciences, March 1982.

[DRC, 1982]

Application of the HARDMAN Methodology to the Division Support Weapon System (DSWS), E-8247U, Dynamics Research Corporation, December 1982.

[Kerwin and Blanchard, 1980]

Kerwin, Walter T., and Blanchard, George S., Man/Machine Interface -- A Growing Crisis, Army Top Problem Areas, Discussion Paper Number 2, US Army Materiel Systems Analysis Activity, August 1980.

[SSC, undated]

Winston, Maria B., Klaas, James L., Holzman, Harold R., Goldman, Lawrence A., and Brandenburg, Raymond G., A Preliminary Report on the Early Comparability Analysis (ECA) Methodology, US Army Soldier Support Center, National Capital Region.

[US Army, 1983]

The FORECAST System Master Plan, US Army, April 1983.

[VRI, 1983]

Miller, G., Bonder, S., Graulich, M., and Zabinsky, Z., Development of an Operational Personnel Long Range Planning System, VRI-USAREC-1 FR83-1(R), Vector Research, Incorporated, 27 May 1983.